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Short Communication

Existing Situation of Solid Waste Management in Pune City, India

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Abstract

At present the most serious problem of pollution is the direct result of human activity. As soon as large settlement and towns become common, the problem of disposal of solid waste arose. India is also experiencing tremendous growth in urban areas. Urban centers of India produce 120,000 tones of solid waste per day. Some metropolitan cities like Bombay, Calcutta, Bangalore, and Pune showing typical urban pollution. Among these Pune is also one of the city which produces large quantity (1000-2000 mt/day) of Municipal Solid Waste (MSW). There is major problem of its disposal and management. Pune Municipal Corporation (PMC) dispose municipal solid waste at Urali Devachi Depot which is 20 km away from pune city. Due to unscientific disposal of MSW the huge hips are produced at the disposal site. The decomposition of waste produce leachate. This leachate gets percolated in surrounding ground water. In the present study leachate and well water of near by area is analyzed for the concentration of chromium and zinc. The analytical data showed that concentration of chromium and zinc in leachate is 5 to 8 mg/l and 10 to 15 mg/l respectively which is more than permissible limit of MPCB (Maharashtra Pollution Control Board). The concentration of .chromium and zinc is 5 to 8 mg/l and 6 to 9.5 mg/l in nearby well water. This clearly indicates that there is higher concentration of these metals in well water. The people residing in these areas are using well water for drinking, domestic and for agricultural use. It is observed that the people living in this area having health and hygienic problems such as allergic, asthmatic, bronchitis, skin irritation and gastro intestinal diseases. These problems are discussed in this paper.

Keywords: Chromium, zinc, MSW, leachate, urali devachi, disposal depot, PMC, MPCB, mansoon, ecological cycle, fossil fuels, exotic, urbanization.

Introduction

Human activities domestic, agricultural or industrial generate huge quantity of waste. The wastes generated from these activities of more advanced society produce more complex and e heterogeneous wastes because of living standards and changing food habits. These activities are changes the quality of waste and increases quantity per capita in recent years. The solid waste problem is much more severe in urban environments[1]. Municipal solid waste (MSW) is being produced since from human civilization. India is experiencing tremendous growth in urban areas. This increased urbanization associated with growing economy has posed a significance stress on the environment. With the increasing industrialization, man is introducing new and complex chemicals without any rigorous bioassesment of their toxicity. Further more continued dispersion of such materials in environment may interfere with the biological processes fundamental to life. Hence, man is now facing the acute problem of environmental pollution. He has utilized science and modern technology for his comfort, pleasure and betterment of living standards. The major urban environmental concerns, like urban air pollution, noise pollution, municipal solid waste management, sanitation and associated adverse health impacts, this increased urbanization with large population density can further intensify these concerns, unless we take urgent effective steps improve sanitation and solid waste management.

Pune city contains lots of commercial industries, Hospitals, hotels, residential buildings as well as high population which generate 0.12 kg of waste per capita/day (Personal communication with PMC office Pune). The municipal solid waste is heterogeneous in nature and contains papers, Plastics, rags, metals, glass pieces, ashes and combustible materials. In addition to these it also contains other substances like scrap materials, dead animals, discarded chemicals, paints, hazardous waste generated from hospitals, industries and agricultural residues. The waste generated from biomedical waste, clinics, hospitals, nursing homes, pathological laboratories, blood banks and veterinary centers have also been disposed along with municipal solid waste at disposal site. This waste is hazardous to human being and environment[2]. Pune Municipal Corporation disposes this waste of pune city at mantarwadi (Urali devachi depot) which is 20 km away from pune city. About 1200-1300 metric tones of solid waste from pune municipal area is disposed per day at Mantarwadi (Urali Devachi village). During the early period, MSW was conveniently disposed off at Mantarwadi disposal site in low lying areas with large open land space. The unscientific disposal of solid waste created lots of environmental problem in this area. It resulted into air pollution and ground water pollution problems. The Well water near to disposal site in Urali Devachi village is now not safe for domestic use (drinking, outdoor bathing, propagation of aquatic life, industrial cooling and for irrigation). It has been found that due to waste disposal the people living in this area face many environmental and health problems.

Material and Methods

Information related to existing situation of solid waste management in pune city was collected from Pune Municipal Office. We also collected

information related to health hazard from the public living near by areas around the disposal site.

Method of disposal: Most of MSW in pune is being disposed unscientifically. Generally MSW is collected and deposited in sanitary landfills. Such unscientific disposal practices attract birds, rodents and fleas to the waste dumping site and create unhygienic conditions. The anaerobic decomposition by microorganisms brings about degradation of most of the solid waste. This results in the emission of carbon dioxide (CO_2), methane (CH_4) and other trace gases Methane gas constitute about 60% in a solid waste landfill[2]. The general anaerobic transformation of solid waste with the help of microorganism can be describe by the following equation

Organic matter+H_2O+Bacteria+ temperature $\rightarrow$ new cells resistant organic matter+CO_2+CH_4+NH_4+H_2S (1)

Under the reducing condition, sulfate reduce to sulfide which subsequently combines with hydrogen to form H_2S

$2CH_3CHOHCOOH+SO_4^{2} \rightarrow 2CH_3COOH+S^{2}+2H_2O+2CO_2$ (2)

$4H_2+SO_4^{2} \rightarrow S^{2}+4H_2O$ (3)

$S^{2}+2H^{+} \rightarrow H_2S$ (4)

Methane gas is explosive in nature and causes the burning of solid waste, thus giving rise to air pollution. Along with methane gas, many toxic, volatile air pollutants are emitted such as chlorinate hydrocarbon compounds like vinyl chloride and tetra chloro ethylene from solid waste landfill[4]. It is found that these air pollutants have caused a plenthora health problem among residents nearby. The burning of waste in summer season due to increase is temperature.

The another problem arise due to unscientific disposal is the water pollution. During land filing of solid waste due to continuous pressure it results quizzing of contaminated liquid called as a leachate. Leachate is liquid emanating from a land disposal cell that contains dissolved, suspended and microbial contaminants from the solid waste[2]. The leachate has high organic contents, soluble salts and other constituents capable of polluting ground water. It is proved that this polluted ground water is unfit for drinking and causes health complaints like jaundice, nausea, asthma, miscarriage and infertility[5]. Now a day it is realized that unscientific solid waste disposal practices is one of the reasons of global warming. So to study quality of air and to study physico-chemical characteristics of the water of urali devachi village there is need to do air monitoring as well as water analysis of the disposal site.

Physico-chemical analysis of well water and leachate: Sample collection: Leachate and ground water was collected from site in the month of June, and Dec.-2010 to Jan.-2011. During the study grab and composite sampling methods are used for sample collection. Two heavy metals i.e. chromium and zinc were analyzed from leachate and ground water. During the study Leachate sampling were carried out two times in mansoon season and two times in winter season by using composite sampling method and well water sampling were carried out three times within twelve months period from two different well by using grab sampling method. (One well is located 800 mtrs. away from landfill site and another well located 1200 mtrs. away from landfill site). The sample collected from the site was analyzed in Tata Motors Pvt. Ltd. laboratory pimpri.

Analytical Methods: The concentration of chromium (mg/l) was carried out by diphenylcarbazid method with the help of UV spectro photometer given in APHA-AWWA-WPCF. The concentration of zinc (mg/l) was carried out with the help of dithiozine method with the help of UV spectro photometer given in APHA-AWWA-WPCF.

Location of sample collection: The samples of leachate have been collected from following locations. **Sample 1:** Leachate samples collected from percolation tanks no. 1, 2 and 3 in the month of June, 2010. **Sample 2:** Leachate samples collected from percolation tanks no. 1, 2 and 3 in the month of Aug, 2010. **Sample 3:** Leachate samples collected from percolation tanks no. 1, 2 and 3 in the month of Nov. 2010. **Sample 4:** Leachate samples collected from percolation tanks no. 1, 2 and 3 in the month of Dec.

The samples of ground water have been collected from following locations. **Sample 1:** i. Well water Sample collected in the month of Jan. 2010, (Well located 800 mtrs away from landfill site), ii. Well water collected in the month of Jan.2010 (Well located 1200 mtrs away from landfill site). **Sample 2:** i. Well water collected in the month of May.2010 (Well located 800 mtrs away from landfill site) ii. Well water collected in the month of May.2010 (Well located 1200 mtrs away from landfill site). **Sample 3:** i. Well water collected in the month of Jul.2010 (Well located 800 mtrs away from landfill site.) ii. Well water collected in the month of Jul.2010 (Well located 1200 mtrs away from landfill site).

Results and Discussion

Pune municipal solid waste: From the overall study of solid waste management in pune city it is observe that Pune city generates about 1200-1300 metric tones of solid waste per day. This unsegregated solid waste is disposed at landfill site near Urali-Devachi village which is 20 km away from pune city. The 43 ha of land allocated for solid waste disposal, from which 15 ha area is already land filled and sealed off permanently. Solid waste generated at disposal site is of two types biodegradable and non-biodegradable is as follows.

Characteristics of waste for pune city. Out of total garbage 70% waste is organic waste, 8% is paper waste, 7% is plastic waste, 4% metal waste, 6% glass waste, and 5% miscellaneous waste. Figure-8 Organic waste includes leaves, timber waste, vegetable extract, kitchen waste, household waste, hotels waste, fruits and juice centre residue etc. Paper waste includes paper dish, news paper, paper box, paper bags, wrapping materials (e.g. soap cover, tooth paste cover, match box cover) etc. Plastic waste includes plastic bags, broken plastic material (e.g. mug, bucket, pipes, plastic covers, plastic wrapping material). Metal waste includes screw, nut bolt, electronic parts, damage vehicle parts etc. Glass waste includes broken glass materials, bear bottle, glass lamp, bulb, tube lights. Miscellaneous waste includes all sanitary waste.

Figure-2 shows that source wise quantity generation of waste in percent at pune city. out of which 40% waste is domestic waste (household) waste, 25% waste is from commercial area, 5% waste is from market area, 25% waste is from hotels and restaurants and 5% waste is of vegetable waste. Recently this MSW is collected, transported from 14 ward that are Aundh, Ghole road, Warje, Karve nagar, Dhole-Patil ward, Yerwada, Sangamwadi, Bhavani peth, kasba, vishrambaug wada, Sahakar nagar, Tilak road, Bibwewadi, Dhankawadi and Hadapsar. The collected MSW waste is disposed at Urali Devachi site which is about 20 km away from Pune, at Devachi Urali. The total cost for collection, transportation and disposal is Rs. 60 crores per year.

Physico-chemical analysis of leachate and water: From figure-3 and table-1 It is indicate that the chromium within the leachate sample is

exceeds the limit. Chromium of sample no. III is more i.e. 8 mg/l. as compare to other sample. From this result it is indicate that leachate sample containing high amount of chromium. Sample result ranges from 5 to 8 mg/l.

From the figure-4 and table -1 it is observe that zinc within the leachate sample is exceeds the limit. Zinc content of sample no. II is more i.e. 15 mg/l. as compare to other sample. From this result it is indicate that leachate sample containing high amount of zinc. Sample result ranges from 10 to 15 mg/l. From table-2 and figure-5 it is observe that the chromium within the well water sample is exceeds the limit. Chromium of sample A within January month is more i.e. 8.2 mg/l as compare to other sample. From this result it is indicate that well water sample containing high amount of chromium. Sample result ranges from 5 to 8 mg/l. From table-2 and figure-6 it is observe that Zinc within the well water sample is exceeds the limit. Zinc content of sample A within July month is more i.e. 9.5 mg/l as compare to other sample. From this result it is indicate that well water sample containing high amount of zinc. Sample result ranges from 6 to 9.5 mg/l.

The analytical data showed that concentration of chromium and zinc in leachate is 5 to 8 mg/l and 10 to 15 mg/l respectively which is more than permissible limit of MPCB (Maharashtra Pollution Control Board). The concentration of chromium and zinc is 5 to 8 mg/l and 6 to 9.5 mg/l in nearby well water (800 and 1200 meters away from landfill site). This clearly indicates that there is higher concentration of these metals in well water. The people residing in these areas are using well water for drinking, domestic and for agricultural use. It is observed that the people living in this area having health and hygienic problems such as allergic, asthmatic, bronchitis, skin irritation and gastro intestinal diseases.

Conclusion

From overall study and analysis is concluded that the solid waste disposal methods at Urali Devachi Depot (Mantarwadi) generate many environmental as well as health hazards within the surrounding area. It also causes harmful health effect on people living in that area. Open dumping of solid waste affect the aesthetic value of the surrounding area of the disposal site. It also produces very bad smell at the time of decomposition process. At the time of decomposition it released a various gases within the surrounding area due to that air get polluted and this pollution leads to global warming. All this gases e.g. SO_2, CH_4, CO_2 etc. are very harmful to human health. The released of this beyond average limit causes disorders related to respiratory tract. Leachate formed from waste mixed with ground water and pollutes that water.

Concentration of all parameters found in well water is exceeds the limit so it is not safe for drinking, commercial used, irrigation and industrial purpose. These leachates have corrosive activity which is also dangerous for human health. So the dumping ground not only affect environment but also damage the property in the vicinity area. The current practices needs to improve for managing waste.

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Table-1
Leachate analysis generated at disposal site which is accumulated in ponds

Parameters	Samples				MPCB consent Limit
	Jul. 2010	Aug.2010	Nov.2010	Dec.2010	
Chromium(mg/l)	7	6	8	5	<0.1 mg/l
Zinc (mg/l)	10	15	13	12	<5 mg/l

Table-2
Showing well Water analysis results which are 800 and 1200 meters respectively away from disposal site

Parameters	Samples						
	Jan.2010		May.2010		Jul.2010		MPCB consent Limit
	A	B	A	B	A	B	B
Chromium(mg/l)	8.2	6.8	7.4	7.5	6.5	6.8	<0.1 mg/l
Zinc (mg/l)	6	7.5	6.6	8.2	9.5	7.5	<5 mg/l

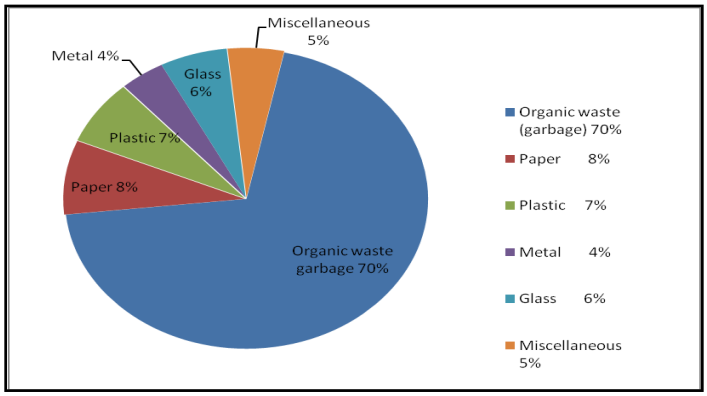

Figure-1
Waste characteristics for Pune

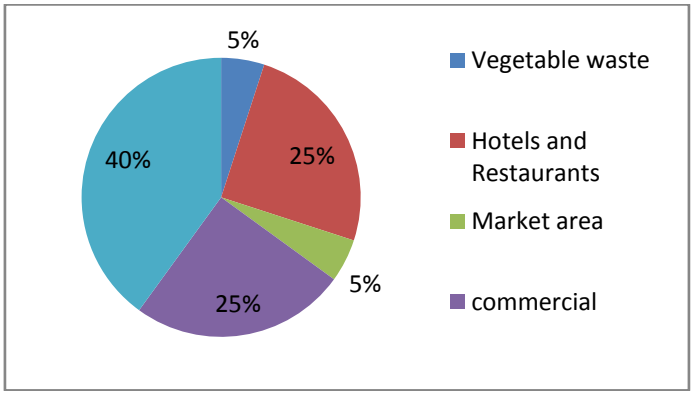

Figure-2
Source wise quantity generation in Pune

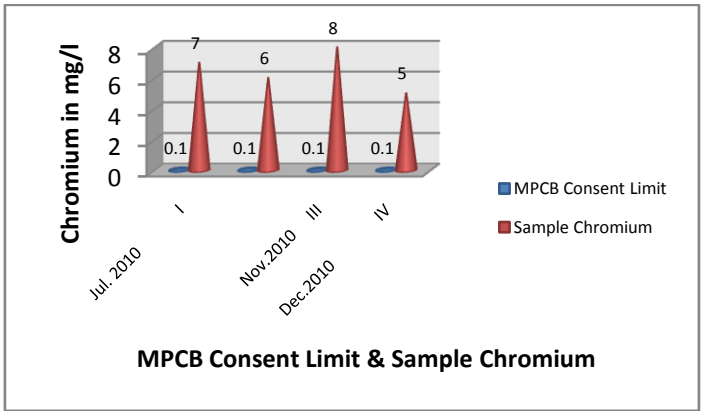

Figure-3
Concentration of chromium in mg/l

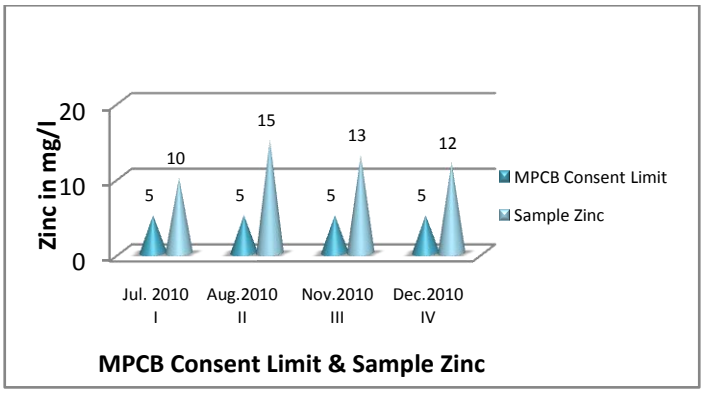

Figure-4
Concentration of Zinc in mg/l

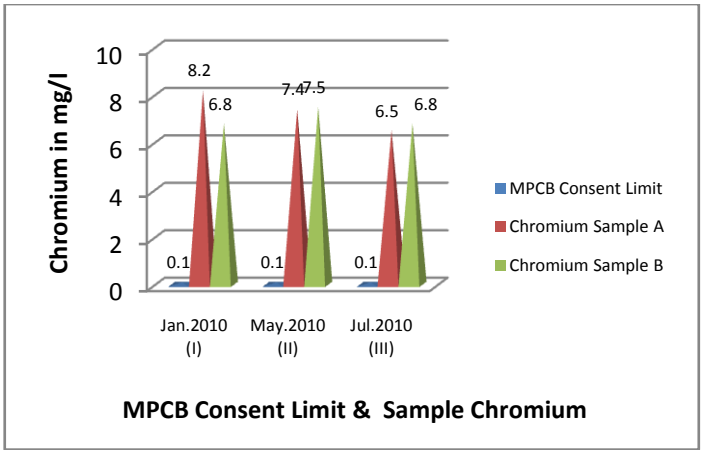

Figure-5
Concentration of Chromium in mg/l

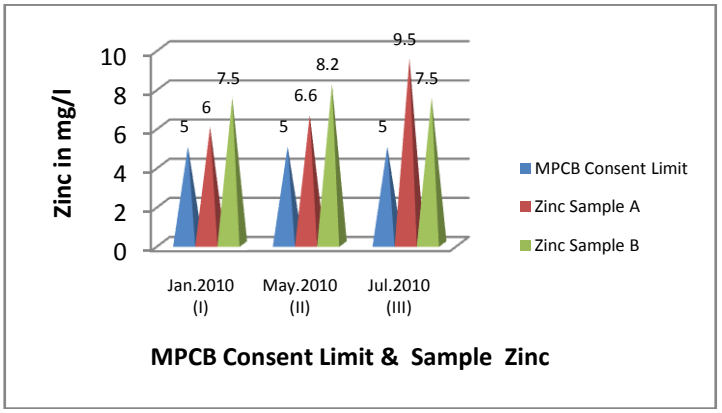

Figure-6
Concentration of Zinc in mg/l